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# First records of *Loxopholis southi* (Ruthven & Gaige, 1924) (Squamata, Gymnophthalmidae) in the Cordillera Oriental of the Colombian Andes

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## Abstract

We present the first records of *Loxopholis southi* (Ruthven & Gaige, 1924) from the western slope of the Cordillera Oriental in Colombia. This species had previously only been known from the biogeographic regions of Chocó and Magdalena River valley in the Cordillera Occidental and Central Colombia, and from Central America. This record expands the distribution of *L. southi* to the Andean mountains of the Cordillera Oriental, crossing the Magdalena River valley. It now constitutes the easternmost known occurrence in Colombia and the highest altitudinal record for this species.

## Keywords

Colombia, distribution, diversity, geographic, lizard, range extension

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## Introduction

The genus *Loxopholis* Cope, 1869 belongs to the family Gymnophtalmidae (Reptilia, Squamata, Sauria) and currently contains 11 recognized species (Pellegrino et al. 2018; Uetz et al. 2021). These small lizards (snout–vent length <50 mm), inhabit leaf litter in Neotropical lowland forests from lower Central America and South America (Mora et al. 2019; Uetz et al. 2021). In South America, all 11 species are present: *L. caparensis* Esqueda, 2005, *L. ferreirai* Rodrigues & Avila-Pires, 2005, *L. guianense* Ruibal, 1952, *L. hexalepis* Ayala & Harris, 1982, *L. ioanna* Uzzell & Barry, 1971, *L. osvaldoi* Avila-Pires, 1995, *L. parietalis* Cope, 1886, *L. percarinatum* Müller, 1923, *L. rugiceps* Cope, 1869, *L. snethlageae* Avila-Pires, 1995, *L. southi* Ruthven & Gaige, 1924 (Pellegrino et al. 2011; Mora et al. 2019; Uetz et al. 2021); whereas in Central America there are only two species currently recorded: *L. southi* and *L. rugiceps* (Mora et al., 2019).

In Colombia, six *Loxopholis* species have been

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reported until now: *L. parietalis*, in the departments of Caquetá (Morelia, Villa Maria) and Putumayo (Mocoa) (Uzzell and Barry 1971); *L. percarinatum* in the departments of Amazonía, Guanía, Guaviare, Meta, and Vaupés (Calderón-Espinosa et al. 2019); *L. ioanna* between Buenaventura and Río Calima, department of Valle del Cauca, its type locality (Uzzell and Barry 1971); *L. hexalepis* in Puerto Carreño, department of Vichada, its type locality (Ayala and Harris 1982); *L. rugiceps* in the Magdalena River basin (Cope 1869), in the Caribbean lowlands, and in the Guiana shield (Gutiérrez and Arredondo 2007); and *L. southi* which is reported across the western and central Andes of Colombia, with its westernmost record on Gorgona Island (Castro-Herrera and Vargas-Salinas 2008), and its easternmost record in Maceo, Antioquia (Gutiérrez and Arredondo 2007). Here, we report the presence of *L. southi* on the western slope of the Cordillera Oriental of the Colombian Andes. Our new records constitute the first report of *L. southi* from this Andean Cordillera and is the highest and the easternmost record of this species.

## Methods

Fieldwork was carried out in the municipalities of Otanche (05°38′07″N, 074°10′44″W) and Muzo (05°33′35″N, 074°08′47″W), Department of Boyacá, in the Cordillera Oriental of Colombia, in March 2019. Two lizards were found during visual encounter surveys. Both individuals were collected by hand, euthanized using 2% xylocaine (Gotte et al. 2016), fixed in 10% formalin, and later preserved in 70% ethanol. Voucher specimens were deposited in the Colección Zoológica at the Universidad del Tolima (CZUT-R).

Species identification followed the descriptions by Ruthven and Gaige (1924), Ruibal (1952), Uzzell and Barry (1971), and Lotzkat et al. (2012). Additionally, Juan Fernando Daza from University of Antioquia, Colombia, confirmed the identity of this species. We made measurements of snout–vent length (SVL) with digital calipers (Mitutoyo, Japan) to the nearest 0.01 mm. We also checked and counted the body and head scales of the two lizards collected according to Köhler (2008). The sex of the two individuals was determined by gonadal examination. Finally, we produced the map showing the distribution of *Loxopolis southi* in Colombia using QGIS v. 3.102 (QGIS 2020) with data obtained from the Global Biodiversity Information Facility (http://data.gbif.org), the voucher specimens from natural history collections (Table 1), and the scientific literature.

**Table 1.** Localities of occurrence for *Loxopholis southi* in Colombia. Data obtained from: Instituto de Ciencias Naturales, Universidad Nacional de Colombia (ICN-MHN), Museo de Historia Natural Universidad de Antioquia (MHUA), Museo de Historia Natural Universidad de Caldas (MHN-UCa), Universidad Tecnológica del Choco (COLZOOCH), Colección Zoológica of the Universidad del Tolima-Reptiles (CZUT-R) and Universidad del Valle del Cauca (UV-C). * indicates new records.

| Department | Locality | Latitude | Longitude | Altitude a.s.l. (m) | Collection code | Catalog no. |
|---|---|---|---|---|---|---|
| Antioquia | San Carlos | 06°13′06″N | 074°50′52″W | 870 | MHUA-R | 12465 |
| Antioquia | San Carlos | 06°13′40″N | 074°52′20″W | 820 | MHUA-R | 12466 |
| Antioquia | Yondó | 06°44′01″N | 074°15′29″W | 90 | MHUA-R | 11993 |
| Antioquia | San Carlos | 06°13′39″N | 074°51′09″W | 860 | MHUA-R | 12106 |
| Antioquia | Maceo | 06°32′49″N | 074°38′37″W | 580 | MHUA-R | 11389, 11391 |
| Boyacá* | Otanche | 05°38′07″N | 074°10′44″W | 1380 | CZUT-R | 0671 |
| Boyacá* | Muzo | 05°33′35″N | 074°08′47″W | 1320 | CZUT-R | 0672 |
| Caldas | Manizales | 05°06′33″N | 075°38′59″W | 920 | MHN-UCa | 223, 228, 227 |
| Cauca | Guapi | Erroneous voucher coordinates | | No data | COLZOOCH-H | 0282 |
| Chocó | Unión Panamericana | 05°19′11″N | 076°37′04″W | 120 | COLZOOCH-H | 2216 |
| Chocó | La Union | 05°16′10″N | 076°13′00″W | 860 | COLZOOCH-H | 0251 |
| Chocó | Río Quito | 05°37′35″N | 076°44′56″W | 40 | COLZOOCH-H | 0073, 0110 |
| Chocó | Tadó | 05°18′57″N | 076°26′05″W | 200 | COLZOOCH-H | 0222, 0227 |
| Chocó | Nuquí | 05°42′45″N | 077°15′56″W | 0 | MHUA-R | 11399, 11400, 11401, 11402 |
| Chocó | Serranía del Baudó | 06°5′27″N | 077°16′06″W | 860 | ICN-MHN | 5477 |
| Chocó | Bahía Solano | 06°15′48″N | 077°23′12″W | 0 | ICN-MHN | 5475, 5476 |
| Risaralda | Pueblo Rico | 05°20′35″N | 076°5′46″W | 480 | ICN-MHN | 6919 |
| Valle del Cauca | Buenaventura | 03°50′32″N | 077°12′02″W | 20 | UV-C | 14053, 15109 |
| Valle del Cauca | Aguaclara | 03°40′22″N | 076°56′40″W | 100 | UV-C | 11641 |
| Valle del Cauca | Anchicaya | 03°36′50″N | 076°54′40″W | 290 | UV-C | 10751 |
| Valle del Cauca | Zabaletas | 03°48′18″N | 076°37′32″W | 1090 | ICN-MHN | 5654 |
| Valle del Cauca | Juanchaco | 03°56′23″N | 077°21′24″W | 30 | UV-C | 8994, 9280 |
| Valle del Cauca | Bahía Málaga | 03°58′43″N | 077°19′59″W | 50 | UV-C | 8989, 8990, 8993 |
| Valle del Cauca | Bajo Calima | 03°59′00″N | 076°56′60″W | 50 | UV-C | 6846 |
| Valle del Cauca | Anchicaya | 03°36′50″N, | 076°54′40″W | 290 | UV-C | 5170, 5167 |
| Valle del Cauca | Bajo Calima | 03°59′47″N | 076°58′28″W | 30 | UV-C | 5171, 5172 |
| Valle del Cauca | Llano Bajo | 03°31′60″N | 076°52′03″W | 640 | UV-C | 279 |
| Valle del Cauca | Bajo Calima | 03°59′52″N | 076°58′41″W | 30 | ICN-MHN | 5473, 5474 |
| Valle del Cauca | Juanchaco | 03°56′23″ N | 077°21′24″W | 30 | UV-C | 8992 |

# Results

***Loxopholis southi* (Ruthven & Gaige, 1924)**
Figure 1

**New records**. COLOMBIA – **Boyacá** • Municipality of Otanche, Vereda Alto Sano; 05°38′07″N, 074°10′44″W; 1381 m a.s.l.; 13.III.2019; Hugo Bernal leg.; in leaf litter in secondary forest at 11:00 h; 1 ♀; SVL 24.2 mm; CZUT-R 0671 • Municipality of Muzo, Vereda Sábripa; 05°33′35″N, 074°08′47″W; 1322 m a.s.l.; 16.III.2019; Hugo Bernal leg.; in litter fall in secondary forest at 20:30 h; 1 ♀; SVL 21.1 mm; CZUT-R 0672.

**Identification.** We identified the specimens collected as *L. southi* because they agree with the descriptions and key proposed for this species by Ruthven and Gaige (1924), Ruibal (1952), Uzzell and Barry (1971), and Lotzkat et al. (2012). Particularly, *L. southi* is recognized from other species of the genus *Loxopholis* in having the frontonasal plate divided (Fig. 2A, C), conical and imbricated scales on the side of the neck (Fig. 2B, D), two pair of genial scales in contact medially but a third pair neither in contact on the midline nor with the lower labials, pregular scales keeled, dorsal scales leaf-shaped, lateral scaless like the dorsals, and ventral scaless in longitudinal rows. The scale counts for our specimens are: rostral 1, prefontals 2, frontonasals 2, frontal 1, frontoparietal 1, parietals 2, interparietal 1, supraoculars 4, transverse dorsal rows 32 (30 in CZUT-R 0672), transverse ventral rows 21, scales about the midbody region 21–23. Our specimens are brown, with the lateral surfaces darker than the dorsum, and a lateral yellow stripe from the neck to the tail. The head is dark brown or black. The gular region and venter are cream-coloured with dark blotches in the venter of the tail.

# Discussion

New occurrence records of a species are important as they delimit the species' distribution, which has fundamental implications for understanding biodiversity, ecology, systematics, biogeography, and conservation (Mota-Vargas and Rojas-Soto 2012). The genus *Loxopholis* is composed of small lizards that prefer semifossorial microhabitats within tropical forests, so they are not easy to detect in the field. We believe that this may be one of the reasons why this species had not been previously recorded from the Cordillera Oriental of Colombia, especially if field searches have not been targeted to find this species. Another possible reason may be attributed to the taxonomic confusion between *L. southi* and *L. rugiceps*, as they have sometimes been misidentified (see Mora et al. 2019), even though *L. southi* differs from *L. rugiceps* in having the frontonasal scale longitudinally divided (versus single in *L. rugiceps*). The lateral scales between the ear opening and the shoulder are

**Figure 1.** *Loxopholis southi* (CZUT-R 0671) Otanche Municipality, Boyacá Department, Colombia.

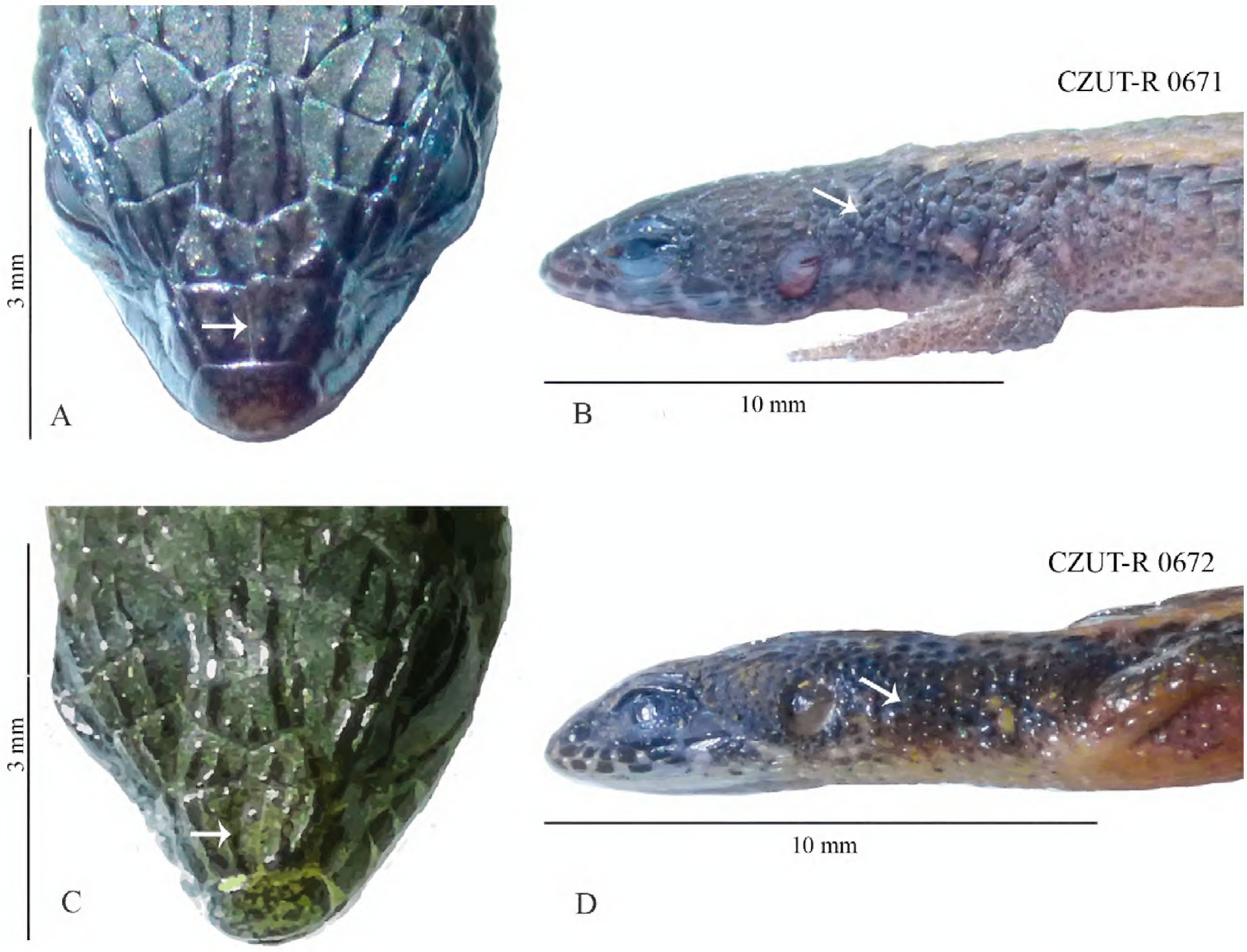


**Figure 2.** *Loxopholis southi*. **A, B.** Dorsal and lateral view of head of CZUT-R 0671. **C, D.** Dorsal and lateral view of head of CZUT-R 0672. **A, C.** Frontonasal scale divided. **B, D.** Conical lateral scales between the ear opening and the shoulder. Scale bars: A, C = 3 mm; B, D = 10 mm.

non-imbricated and conical (Fig. 2B), different from *L. rugiceps* which has them imbricated and keeled. Nevertheless, this confusion may be erroneously reinforced due to the previous reports on the geographic distribution of both species, as *L. rugiceps* occurs in eastern Colombia, the Caribbean lowlands, the Magdalena River valley, and o the Guiana shield (Gutiérrez and Arredondo 2007; Mesa-Joya and Ramos-Pallares 2015), while *L. southi* is mainly distributed in western Colombia (Table 1). Hence, our new records are significant given that they extend the geographical distribution approximately 99 km (Otanche record) and 106 km (Muzo record) southeast in a straight line from the nearest previously reported locality in Maceo (Antioquia). The new records also show that *L. southi* occurs in the eastern mountains of Colombia (Fig. 3).

The individuals collected were found in the leaf litter of two patchy, secondary sub-Andean forests with a canopy higher than 15 m (Fig. 4). The forests exhibited trees with a high density of bromeliads and epiphytes, immersed within a general matrix composed of cultivated areas and pastures dedicated to livestock. The forest floor had a large amount of leaf litter, which reached more than 20 cm thick in some areas. When we moved the leaf litter, we just observed the lizards and a great variety of ants, insect larvae, beetles, termites, and other invertebrates, which probably contribute to the diet of these small animals and other leaf litter vertebrate fauna. When collecting the lizards, the ambient temperature at both localities was around 28–30 °C (25 °C in the leaf litter) and the relative humidity was 90–94%. In general, the type of microhabitat where the two individuals were found agrees with previous habitat descriptions of *L. southi* (Gutierrez and Arredondo 2007), as well as for many lizards of the genus *Loxopolis* which are an important component of the leaf litter herpetofauna of Neotropical forests (Mora et al. 2019).

Our two new records extend the known geographic distribution of *L southi* from the western and central Cordilleras to the Cordillera Oriental of the Colombian Andes, interestingly crossing the lowlands of the Magdalena River valley. In addition, the individual found at Otanche (CZUT-R 0671) constitutes the highest altitudinal record for this species (1381 m a.s.l.), followed by the report from the locality of Muzo (CZUT-R 0672; 1322 m a.s.l.). This species had been previously recorded from 5 to 1093 m a.s.l. (Table 1). Therefore, we suggest that more surveys and fieldwork are necessary along with the Cordillera Oriental to identify new localities and improve the knowledge of the entire distributional range of *L.*

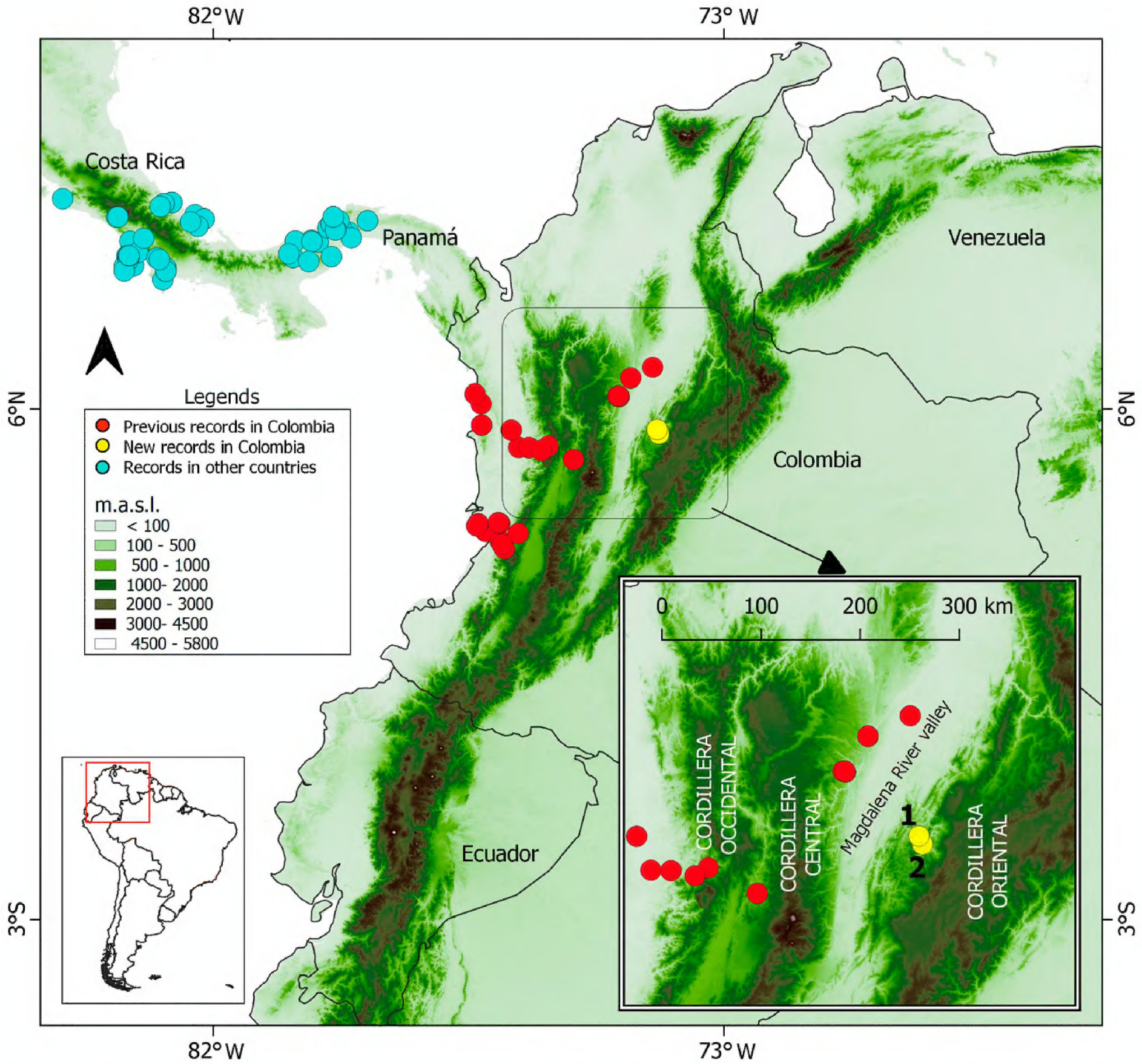


**Figure 3.** Geographic distribution of *Loxopholis southi*. Red circles: previous records in Colombia; yellow circles: new records in Colombia, 1 = Municipality of Muzo, 2 = Municipality of Otanche; blue circles: records in other countries.

*southi* in Colombia. Furthermore, to fill the information gap on the distributional of the biogeographic regions of Chocó and Magdalena River valley, which share many species of flora and fauna with the Cordillera Oriental (Hernández-Camacho et al. 1992), such as the lizard *L. rugiceps* (Lotzkat et al. 2012) and now *L. southi*. Finally, these new geographic locations can be useful for assessing cryptic species, phylogenetic relationships among *Loxopholis* species, and interestingly exploring the spatial origin of true parthenogenesis described in Neotropical lizards (Brunes et al. 2019).

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## Authors' Contributions

Conceptualization: AMM, HBH, MHB. Data curation: HABH, MHHB, AMM. Formal analysis: HBH, AMM, MHB. Investigation: AMM, HBH, MHB. Software: HBH. Visualization: HBH. Writing – original draft: HBH. Writing – review and editing: HBH, MHB, AMM.

## References

Ayala SC, Harris DM (1982) Una nueva especie de microteido (Sauria: Teiidae) del oriente de Colombia. Caldasia 13 (63): 467–472.

Brunes TO, da Silva AJ, Marques-Souza S, Rodrigues MT, Pellegrino, KC (2019) Not always young: the first vertebrate ancient origin of true parthenogenesis found in an Amazon leaf litter lizard with evidence of mitochondrial haplotypes surfing on the wave of a range expansion. Molecular Phylogenetics and Evolution 135:

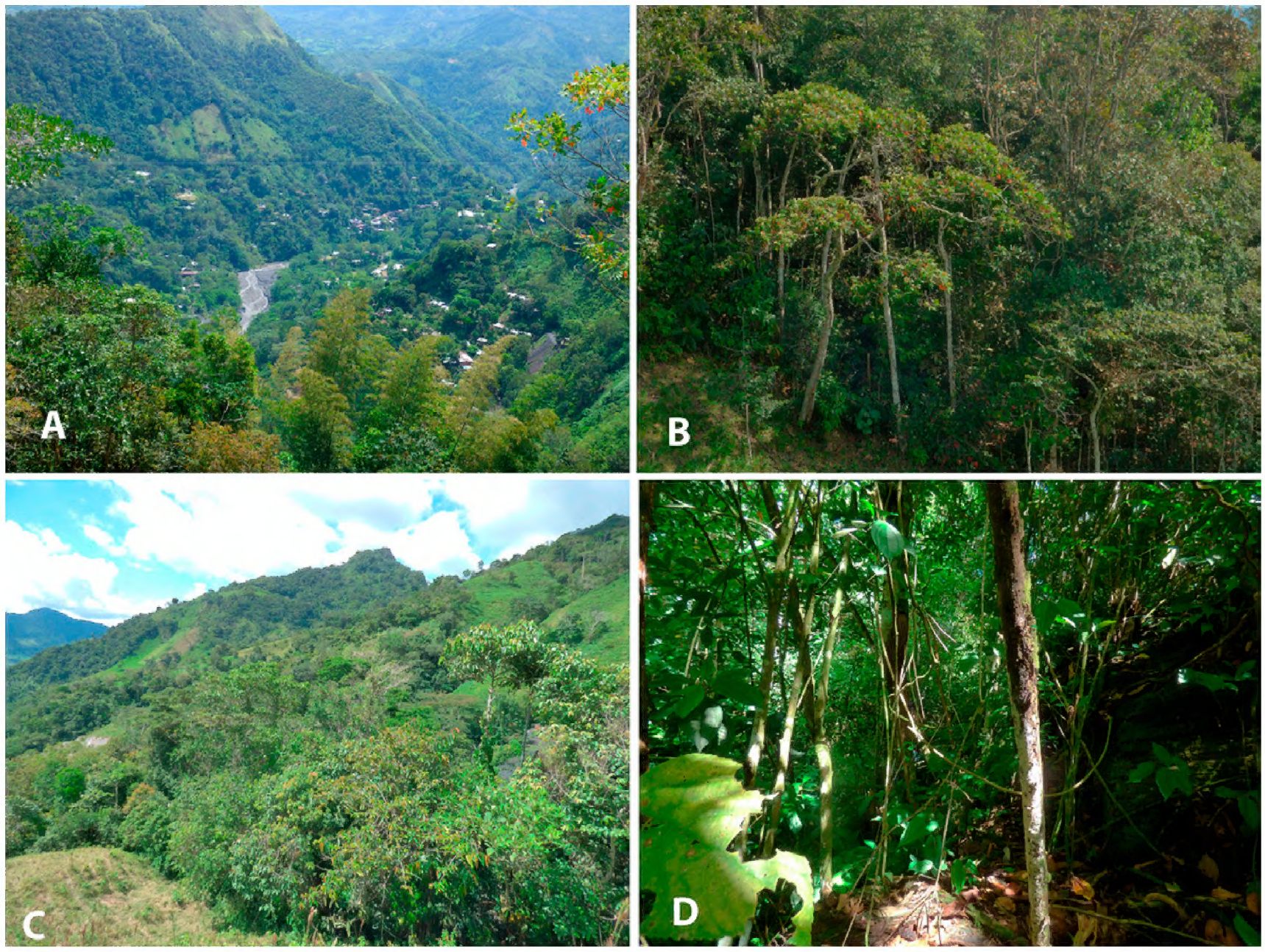


**Figure 4.** Habitat of *Loxopholis southi* reported in the present study, in Department of Boyacá, Colombia. **A, B.** Municipality of Otanche. **C, D.** Municipality of Muzo. Left side: Interior of the secondary forest; right side: collection site of lizards.

105–122. https://doi.org/10.1016/j.ympev.2019.01.023

Calderón-Espinosa ML, Medina-Rangel GF, Jerez A, Ríos-Orjuela JC, López-Perilla YR (2019) Anfibios y reptiles del municipio de San José del Guaviare (Guaviare, Colombia). Serie Guías de Campo del Instituto de Ciencias Naturales No. 24. Instituto de Ciencias Naturales Universidad Nacional de Colombia, Bogotá, Colombia, 290 pp.

Castro-Herrera F, Vargas-Salinas F (2008) Anfibios y reptiles en el departamento del Valle del Cauca. Biota Colombiana 9 (2): 251–277.

Cope ED (1869) Sixth contribution to the herpetology of tropical America. Proceedings of the Academy of Natural Sciences of Philadelphia 20: 305–313.

GBIF (2021). The Global Biodiversity Information Facility. https://www.gbif.org. Accessed on: 2021-06-12.

Gotte SW, Jacobs JF, Zug GR (2016) Preserving reptiles for research. In: Dood CK (Ed.) Reptile ecology and conservation: a handbook of techniques. Oxford University Press, Oxford, UK, 73–86. https://doi.org/10.1093/acprof:oso/9780198726135.003.0006

Gutiérrez Cárdenas PD, Arredondo JC (2007) *Leposoma southi* Ruthven & Gaige, 1924, a new record to the fauna of Antioquia (Colombia). Herpetozoa 20: 77–79.

Hernández-Camacho J, Hurtado A, Ortiz R, Walschburger T (1992) Unidades biogeográficas de Colombia. In: Halffter G (Ed.) La diversidad biológica de Iberoamérica. Instituto de Ecología, A.C, Xalapa, Mexico, 105–151.

Köhler G (2008) Reptiles of Central America. 2nd edition. Herpeton-Verlag, Offenbach, Germany, 400 pp.

Lotzkat S, Hertz A, De Leon R, Köhler G (2012) Distribution extension for *Leposoma rugiceps* (Cope, 1869) (Squamata: Gymnophthalmidae) in Panama, with first record from Bocas del Toro province. Check List 8 (3): 520–524. https://doi.org/10.15560/8.3.520

Meza-Joya FL, Ramos-Pallares E (2015) New records, range extensions and updated distribution of two gymnophthalmid lizards from the Caribbean Region, Colombia. Check List 11 (5): 17–35. https://doi.org/10.15560/11.5.1735

Mota-Vargas C, Rojas-Soto OR (2012) The importance of defining the geographic distribution of species for conservation: the case of the Bearded Wood-Partridge. Journal for Nature Conservation 20 (1): 10–17. https://doi.org/10.1016/j.jnc.2011.07.002

Mora J, Espinal M, Chaves G, López L (2019) Distributional records for *Loxopholis rugiceps* Cope, 1869 (Squamata, Gymnophthalmidae) in Central America. Check List 15 (3): 363–368. https://doi.org/10.15560/15.3.363

Pellegrino K, Rodrigues M, Harris D, Yonenaga-Yassuda Y, Sites JW Jr (2011) Molecular phylogeny, biogeography and insights into the origin of parthenogenesis in the Neotropical genus *Leposoma* (Squamata: Gymnophthalmidae): ancient links between the Atlantic Forest and Amazonia. Molecular Phylogenetics and Evolution 61: 446–459. https://doi.org/10.1016/j.ympev.2011.07.010

Pellegrino K, Brunes T, Marques de Souza S, Laguna M, Avila-Pires T, Hoogmoed M, Rodrigues M (2018) On the distinctiveness of *Amapasaurus*, its relationship with *Loxopholis* Cope 1869, and description of a new genus for *L. guianensis* and *L. hoogmoedi* (Gymnophthalmoidea / Ecpleopodini: Squamata). Zootaxa 4441 (2): 332–346. https://doi.org/10.11646/zootaxa.4441.2.8

QGIS (2020) QGIS Geographic Information System. QGIS Association. http://www.qgis.org.

Ruibal R (1952) Revisionary notes of some South American Teiidae. Bulletin Museum Comparative Zoology 106: 475–529.

Ruthven AG, Gaige HT (1924) A new *Leposoma* from Panama. Occasional Papers of the Museum of Zoology, University of Michigan 147: 1–3.

Uetz P, Freed P, Hošek J (2021) The reptile database. http://www.reptile-database.org. Accessed on: 2021-6-26.

Uzzell T, Barry JC (1971) *Leposoma percarinatum*, a unisexual species related to *L. guianense*; and *L. ioanna*, a new species from Pacific Coastal Colombia (Sauria, Teiidae). Postilla 154: 1–39.